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Handbook for Design of Containers of Fluids and Gases for Spacecraft

This handbook is intended to guide engineers in selection of construction materials for design and fabrication of containers for liquids and gases used in rockets and spacecraft; it may also interest those concerned with the storage or transportation of chemicals.

The materials to be contained include liquid or gaseous oxygen, special fuels, halogen compounds, white fuming nitric acid, and many other chemical propellants. For these materials it is recommended that the containers be constructed of either one of five aluminum alloys, one of two titanium alloys, Inconel-718, one of eight ferrous alloys, or a fiberglass-epoxy composite. General procedures in the screening of such construction materials are outlined, and the effects of fabrication processes on their properties are considered.

Methods of design, fabrication, post-fabrication treatment, nondestructive testing, and repair are described in detail. Limitations on duration of storage and special precautions regarding proximity of other materials stored nearby are prescribed.

Choice of construction materials was guided by the following considerations: whether gas or liquid was to be contained, the anticipated histories of temperature and pressure, the environments of storage and mission, the volume to be contained, the space available for the container, weight, and whether or not the system was to be man-rated. Cost also was a factor, but less so than it would be in commerce; mission environment would not be a factor in commerce, and the different requirements regarding weight, volume, and capacity would cause great changes in design, choice of construction materials, and method of fabrication.

Note:

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